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ABSTRACT

This annotated bibliography of research articles pertaining to the use of computer-assisted instruction (CAI) in the development of reading comprehension skills in students of all ages and abilities is introduced by brief statements of the problem addressed and the purpose, organization, and limitations of the study. A glossary is also provided. Ten of the 22 research articles are concerned with grades K-6, six with grades 7-12, three with the university setting, two with military personnel, and one with adults with special needs. The findings of the research studies are summarized, and its is concluded that: (1) because CAI allows individualized curricula, students generally learn more efficiently; (2) students generally spend more time on CAI lessons involving reading comprehension; and (3) an increase in interest and motivation is almost always assured when CAI is the method of teaching or practicing reading comprehension skills. Four recommendations for use of CAI for reading instruction and further research conclude this study. A 33-item bibliography and a curriculum vitae for the author are also included. (CGD)

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AN ANNOTATED BIBLIOGRAPHY SUMMARIZING AND ANALYZING RECORDED RESEARCH ON THE TOPIC OF COMPUTER ASSISTED INSTRUCTION AND ITS EFFECTS ON READING COMPREHENSION

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INTRODUCTION

Icabone and Hannaford (1986) explain the dilemma. "It is an accepted fact today in education that schools must prepare for society's entry into the information age, while maintaining excellence in the basic academic subjects, and must be prepared to do so with decreasing local, state, and federal support. Therefore, it is important to begin to search for ways in whch the schools can 'do more with less.'" How can Computer Assisted Instruction (CAI) help teachers and students economize their time and their funds? How can CAI stretch educators and dollars to the highest level of efficiency in the Reading classroom? "Children learn to read only through materials and activities that make sense to them" (Smith, 1985). Computers offer an enormous array of input/output devices which create possibilities for diverse student needs. Features, such as immediate feedback; multi-language capabilities; impartiality; self-selection and pacing; and non-threatening challenges, satisfy unique interests. (Thompson, 1980) Research done on the effects of computer assisted instruction and reading comprehension illustrates the need for educators to utilize the computer more extensively in their quest for student literacy.

Research on the topic of CAI and reading comprehension was initialized in 1960 through the "Programmed Logic and Automatic Teaching Operation" (PLATO) Project at the University of Illinois. Through further development over the past 20 years, PLATO "has been used to teach beginning reading, college English, and reading comprehension for students attempting the GED examination" (Mason, 1980). In 1963, the first attempt to utilize CAI in Reading at the elementary school level was made. This project, sponsored by Stanford University, found

that significant gains in several areas of Reading could be measured when CAI was part of the teaching/learning process. The project also documented the capabilities of the computer to individualize instruction according to the abilities of each student (Marsh, 1985).

A third major project completed the stage for future investigations. This project, Time-shared, Interactive, Computer-Controlled Information Television (TICCIT) took advantage of video tapes and color television to create a motivating, interactive means of successfully administering reading instruction without the expense of large amounts of computer equipment (Gambrell and McLaughlin, 1985).

From these roots have evolved studies which illustrate uses of computers in many aspects of reading comprehension acquisition. From the earliest stages of primary reading skills to the most sophisticated areas of human knowledge acquisition through Reading found in the university setting, computers are making their mark.

STATEMENT OF THE PROBLEM

"CAI in reading is being used on a daily basis in hundreds of schools throughout the U.S. Today's reading teacher has not and will not be replaced by the computer. Instead, the computer is supporting teachers in their attempts to deliver quality and affordable individualized reading instruction" (Blanchard, 1980). The effects that CAI may or may not have on the acquisition of reading comprehension skills are not well documented. This study dealt with compiling research on the effects of CAI on the acquisition of reading comprehension skills in people of all ages and abilities.

PURPOSE OF THE STUDY

In reviewing the research done on the effects of computer assisted instruction on the acquisition of reading comprehension skills, it is hoped that educators will develop a better understanding of how to effectively use the computer to aid in their quest for student literacy. Awareness of the potentials of computers in the area of reading comprehension especially for individualization of instruction and economization of time and resources is an anticipated result.

ORGANIZATION OF THE STUDY

Since the array of skill development necessary for reading comprehension is different for different ages and abilities of students, the annotations attempt to follow a time-line format in student maturation. A "special applications" section is allowed at the end of the study to document work that has been done with people whose exceptionalities create a great gap between their age and their intellectual development. Some overlap will be noted in grade-level despite the major breaks in which the research is organized. This is due to the grade-levels studied in the individual documents. When this occurs, the grade-level of the majority of subjects was considered to be the criteria for placement in a particular catagory.

LIMITATIONS OF THE STUDY

In researching the uses of CAI in schools, the discovery was made that many articles have been written concerning reading instruction in general. Many articles based on theory were also discovered in the area of computer assisted

instruction and the Reading classroom. This study focuses only on the specific reading skill called comprehension, and the annotations selected were those that were actually research studies which applied computer assisted instruction and recorded the way that it aided students in the acquisition of reading comprehension skills.

GLOSSARY

comprehension --the act of understanding the meaning of written or spoken language. (Good, 1973)

computer --"A device that receives and then follows instructions to manipulate information. The set of instructions and the information on which the instructions operate are usually varied from one moment to another." (Vandemark, 1983)

computer assisted instruction (CAI) --"A computer assisted instruction system which has a continual input/response capability for a lesson under study between the student and the computer. A conversational mode of presenting information and recording responses. An interactive system." (Jelden, 1980)

gifted child --"(1) the child whose mental age is higher than his actual age when compared with his peers. (2) a child more highly educable than the majority of children." (Good, 1973)

Hawthorne Effect --"increase in motivation deriving apparently from an increase in a group's morale because the group perceives itself as receiving special treatment or consideration." (Good, 1973)

high-incidence handicapped students --students who are both learning disabled and mild mentally handicapped. (Harper and Ewing, 1986)

individualized instruction --"A course of study or program fitted to the individual learner's background, abilities and needs, in which the learner has some input into the selection of materials and proceeds at his/her own pace. (Jelden, 1980)

learning disabled students --students whose "normal (as opposed to retarded) general intellectual ability associated with a significant discrepancy between the expected level of academic performance (as determined through individually administered intelligence tests) and actual levels of achievement in major areas of academic endeavor (as reflected in individual and group achievement-test indices)." (McDermott and Watkins, 1983)

retardation, mental --"a term reflecting conditions characterized by slow maturation, inadequate social adjustment, and/or reduced learning capacity. The conditions may occur synonomously or singly and are associated with intellectual functioning outside the average range." (Good, 1973).

ANNOTATIONS

CAI AND READING COMPREHENSION. RESEARCH IN THE ELEMENTARY GRADES: (GRADES K-6)

Zuk, Dori. "The Effects of Microcomputers on Children's Attention to Reading." Computers in the Schools 3.2 (Summer, 1986): 39-51.

The purpose of this investigation was to analyze the effects of microcomputer presentation on children's attention to the task of reading a story. Fifty-five students from two grade levels (3rd and 5th); two modes of presentation (computer and paper and pencil); and three achievement levels (good, average, and poor) were analyzed in relation to four variables. The four variables were total completion time, comprehension, time off task, and frequency off task. A videotape was used to assess all but the comprehension variable. The only significant finding was that time to complete the task was longer in the computer mode than in the paper text version. When asked, students overwhelmingly preferred the computer presentation, but they did not perform better when reading from the computer than when reading from text.

McDermott, Paul A., and Marley W. Watkins. "Computerized Vs. Conventional Remedial Instruction for Learning-Disabled Pupils." Journal of Special Education 17.1 (1983): 81-88.

Two hundred fifty learning-disabled students enrolled in grades one through six of a suburban Southwestern school district made up the population in this study. Its purpose was to discover the differences in learning after administration of computerized and conventional remedial instruction. Ninety-six students were assigned to either the CAI Math or the CAI Spelling portion of the project. The remaining 154 students were administered conventional instruction in remedial Spelling and Math. The study found no support for the hypothesis that CAI is more effective than regular remedial instruction in the areas of Math and Spelling.

Wells, Bethany J., and D. Scott Bell. "A New Approach to Teaching Reading Comprehension: Using Cloze and Computer-Assisted Instruction." Educational Technology 20.3 (March, 1980): 49-51.

The project described here was one conducted with elementary aged Pueblo Indian students. Using a computer, and a modified cloze procedure, these students were offered the opportunity to learn to read using materials that were relevant to them in their culture. Through this approach, students were aided in developing strategies for reading such as prediction, internalization of word and letter expectancy in printed text, active participation, and a development of a sense of logic in writing.

Icabone, Dona G., and Alonzo E. Hannaford. "A Comparison of Two Methods of Teaching Unknown Reading Words to Fourth Graders: Microcomputer and Tutor." Educational Technology 26.2 (February, 1986): 36-39.

The purpose of this study was to investigate the efficiency of the microcomputer and a speech synthesizer to administer vocabulary instruction to fourth-grade students as compared to that of a human tutor. This study found that the microcomputer with a speech synthesizer was equally as effective as a human tutor in helping students recognize previously unknown words, and in recalling these words after practice. The writing recommended that the computer be considered as a means to obtain individualization in regular classroom settings.

Rashotte, Carol A., and Joseph K. Torgesen. "Repeated Reading and Reading Fluency in Learning Disabled Children." Reading Research Quarterly 20.2 (Winter, 1985): 180-188.

This study attempted to investigate two aspects of the repeated reading method. Because the method used allowed control of the word and context characteristics of the material by using computer-generated formats, the results were hoped to indicate how repeated reading is reliant on these characteristics for its effectiveness. The study also investigated the effects of repeated reading vs. non-repeated reading when the same amount of readings are given. Twelve nonfluent, learning disabled students from age 8.6 to 12.0 years were grouped into six pairs with each pair matched according to reading score. Each pair read 44 passages. 37 were designed with minimal word overlap among the stories and unrelated content. The last seven stories contained high degrees of shared words. Findings indicated that reading speed, word accuracy and comprehension depend upon the degree of word overlap among passages read in different sessions. Error reduction or comprehension gains were not significantly enhanced with the use of shared words. Repeated readings were also found to be ineffective in the acquisition of broad ranges of reading skill.

Pitts, Murray M., and others. Teaching Comprehension-Monitoring with Microcomputers. 16 November, 1983 ERIC Silverplatter. 1985. record no. ED243095.

One of six identified obstacles to comprehension were embedded in each of 24 passages used on 41 fourth-grade students in this study. As the students attempted to overcome the obstacles, the computer helped them by giving them ideas on how to think through the passage. Two control groups and two experimental groups of students were randomly selected. One control group and one experimental group were pretested using the Real World Reading Test. The other control and experimental groups were not administered this test. All subjects completed this test after the experiment was conducted. All subjects also took the Gates-MacGinitie reading comprehension test prior to the initiation of the project. The study found no statistically significant factors that support positive correlation between the use of microcomputer software or hardware and the acquisition of comprehension monitoring skill in elementary school children.

Pitts, Murray M.; and others. Comprehension Monitoring: Longitudinal Unobtrusive Measurement with Microcomputers. April, 1983 ERIC Silverplatter. 1983. record no. ED233309.

A three-fold purpose was identified for the research done here. Software development for comprehension monitoring purposes was the first goal. The second was testing of the effectiveness of this software, and the third was to observe the process of comprehension monitoring using fifth grade students. Six obstacles to comprehension were embedded in each of 24 passages. As each obstacle was confronted, the computer gave a hint as to how to overcome the obstacle. A Real World Reading Test was developed to test the success of comprehension-monitoring training. 40 fifth-grade students were divided into two groups. Half of the experimental goup and half of the control group were administered a pretest. All students were exposed to 12 15-minute computer-reading sessions. The computer collected data on student progress. The training of comprehension-monitoring using the computer showed no significant increase in comprehension scores according to this study; however, the experimental subjects applied more comprehension strategies than did the control group during the testing phase.

Reinking, David and Robert Schreiner. "The Effects of Computer Mediated Text on Measures of Reading Comprehension and Reading Behavior." Reading Research Quarterly 20.5 (Fall, 1985): 536-552.

Four experimental conditions were employed in this study. One group, the control group, read from a printed page. A second group read passages displayed by the computer, but were unable to manipulate the test in any way. A third group was allowed to select the way that they wished to manipulate the text they read on the computer screen according to their preference. They could choose to review vocabulary; see an easier version, look at background information; read the main idea, or reread the entire passage. The fourth group was required to do each manipulation for each passage. 364 fifth and sixth grade students were used in this investigation. The students crossed all levels of reading ability. "Good" readers, according to this experiment scored above or equal to the 75th percentile on the Stanford Achievement Test, Intermediate Level II. Persons scoring lower than the 50th percentile were considered "poor" readers. Children between the 50th and 75th percentile were not used in the study. After reading and studying a passage using options available to him/her, a student indicated readiness for a comprehension test. Comprehension scores were highest in the "all options" group, and lowest for the on-line test only group in the "good readers" catagory. the "poor readers" scored lowest on the microcomputer option which allowed only testing when they deciphered passages of low difficulty. On passages of higher difficulty, the "poor readers" scored lowest when off-line. The students who were off line scored higher than those who were allowed to select their manipulations in all catagories except the "good readers" and when difficult passages were used. When given postexperimental comprehension tests, the "good readers" comparisons were statistically nonsignificant, but the differences between poor readers in the off-line strand and the select-options catagory were significant. The findings suggest that selecting textual manipulations may negatively affect comprehension when compared to reading text off-line. In discussion of the study, the author suggested that the computer offers a unique way to manipulate text for students in their quest for comprehension, but that choice should be eliminated for students at this age level.

Martha Holden Jennings Foundation. Results of Computer Assisted Instruction at Bath Elementary School. 1979 ERIC Silverplatter. 1979. record no. ED195245.

One hundred sixth-grade students at Bath Elementary School in Richfield, Ohio, were exposed to computer assisted instruction either in the area of enrichment or remediation on a daily basis. The studied areas were remedial reading, mathematics, and vocabulary. Students gained an average of 2.4 more months in reading proficiency during the semester they used computers than they did during the semester that they did not use the computers.

Ngalyaye, Morven S. W. and Arie VanderPloge. Differential Effectiveness of Three Kinds of Computer-Assisted Instruction. April, 1986 ERIC Silverplatter. 1986. record no. ED277335.

The population in focus in this study was the economically disadvantaged in grades 2 through 8. Its purpose was to see if CAI improved achievement in this group more than conventional or non-CAI programs, and to discover the variance between CAI program design and systems on the effectiveness of CAI. The group of educationally disadvantaged children numbered over 950 students in a large, urban school system. In addition to these students, 395 students were identified as a control group. The standardized achievement battery used by the school system was used to measure effectiveness of the program. The results of the study indicated that there was no significant evidence that disadvantaged students learned more when exposed to computer assisted instruction. The effect of CAI did not vary with the system used, or the approach taken to CAI. More specifically, school-based computer programs, vendor-based computer programs, and system-wide programs in CAI did not affect the achievement of disadvantaged students.

CAI AND READING COMPREHENSION: RESEARCH IN SECONDARY SCHOOLS (GRADES 7 THROUGH 12)

Harper, Janice A., and Norma J. Ewing. "A Comparison of the Effectiveness of Microcomputer and Workbook Instruction on Reading Comprehension Performance of High-Incidence Handicapped Children." Educational Technology 26.5 (May, 1986): 40-45.

A study was conducted "to compare the effectiveness of microcomputer and workbook instruction on silent reading comprehension performance of high incidence handicapped students." Measures of effectiveness included the productivity of the student as well as attention to the task. Using an alternating treatment design, two female and seven male 11.5 to 13.5-year-old special education students were studied. The students were learning disabled and mildly mentally handicapped. These students proceeded through a three-phase design which included: 1) the collection of baseline data; 2) alternation of microcomputer and workbook instruction for twenty minutes each session for 16 sessions; and 3) a follow up which implemented the most effective treatment for each child. In terms of productivity (defined as the "number of comprehension questions answered correctly"), eight of the nine subjects benefitted most from the use of the microcomputer; however, no distinct differences were apparent in attention to the task. A majority of the students preferred the computer over the workbook as a method of instruction; felt they learned more from using the computer; and would select the computer over the workbook as a tool to practice reading comprehension skills.

Johnson, Gary, Russel Gersten and Douglas Carnine. "Effects of Instructional Design Variables on Vocabulary Acquisition of LD Students: A Study of Computer-Assisted Instruction." Journal Of Experimental Education 20.4 (April, 1987): 206-213.

The researchers in this study wished to investigate the effects of the size of the teaching set and cumulative review procedures on the acquisition of vocabulary word recognition and definition. Twenty-five Learning Disabled adolescent students from a high-school in the Northwest were chosen as the subjects of the study. The group was pretested, matched according to results of the pretest, and split into two study groups. The "Small Teaching Set" group was pretested by the computer program, and was exposed to practice on only those words that they did not know. They practiced a maximum of seven unknown words in three different formats. When they responded correctly four consecutive times to an exercise based on an unknown word, that word was removed from the list and placed in a "learned word" list. After ten words were in the "learned word" list, a cumulative review exercise was administered, and any words not recognized were placed back into the practice set. The "Large Teaching Set" practiced 25 words at a time. Some of these words were already known, but the program offered no individualization in regard to known words. Each time the program is run, the same 25 words appear in the same order, thus, review was based on repetition of words each consecutive run of the program.. The significant finding of the study was that the students who were exposed to a program with a small, individualized set of words to master, acquired mastery in a significantly shorter period of time than those students who were exposed to a larger, more general set of words.

Diamond, James J. A Report on Project GROW: Philadelphia's Experimental Program in Computer Assisted Instruction. August, 1969 ERIC Silverplatter. 1969. record no. ED035272.

Two junior-high schools and two senior high schools in Philadelphia administered computer assisted instruction to its students in the areas of developmental reading and Biology. The Reading results will be of concern in this abstract. Reading data that were considered valuable were collected from standardized test scores on the Gates-MacGinitie Reading Tests and teacher/student questionnaires. At the junior high school, significantly higher scores were obtained on the standardized test for the groups that participated in CAI classes. At one of the high schools, no significant differences were noted between the traditionally instructed classes and the CAI groups. A second high school showed a substantially higher performance for the CAI students, although two different teachers taught the two groups, so the results might have been muddled by differences in methods of presentation rather then methods of learning.

Mizner, Heather. "Microcomputers in the English Classroom: What are the Effects of Computer Graphics, and Interactive Computer Assisted Learning on Student Comprehension of a Poem?" English Quarterly 18.2 (Summer, 1985): 89-96.

Three modalities were chosen to present a poetry lesson to twenty-seven eighth-grade students. Two modalities dealt with computer assisted learning strategies, and one modality was a traditional paper and pencil lesson. The two computer modes differed in their use of technology to differentiate lesson format from a traditional technique. One computer lesson was interactive, and the other, more straightforward. The research question was, "would one modality be more effective in conveying the content of the lesson to the students than another? The study chose a post-test and a videotape to examine the effects of the different modalities on student learning. Post-test results showed no significant differences between the three teaching modalities; however, the videotape revealed that the computer groups spent significantly more time on the lesson than the group who worked on the printed lesson. More enthusiasm was evident for those using the computer as well, according to those who analyzed the videotape.

Miller, Garnet, and Alan Macleod. Microcomputer Learning Project, Willow Creek Elementary School Division No. 28. September, 1984 ERIC Silverplatter. 1984. record no. ED268985.

Many research questions were addressed in this study; however, the one that is of interest in this writing is the question of whether the treatment group would perform at a higher level of proficiency on selected standardized test measures than the comparison group. One hundred and twenty-one sixth through ninth grade students were selected for the project, 80 from Willow Creek School Division No. 28, and 42 from a closely related school in the county of Lethbridge No. 27. The Lethbridge students were used as controls for the Willow Creek students. The students were identified as "gifted" or "average" for purposes of this study. Each student was exposed to eighty minutes of project time, including instruction and application time. The results indicated that reading comprehension was the only Canadian Test of Basic Skills area that was significantly different in the treatment group than the comparison group. Because this was the only affected area, the researchers cautioned against drawing conclusions that computer assisted instruction affects standardized test scores.

Carver, Ronald P., and James Hoffman. "The Effects of Practice Through Repeated Reading on Gain in Reading Ability using a Computer-Based Instructional System. Reading Research Quarterly 16.3 (1981) p. 374-390.

The purpose of this study was threefold. The first reason that this study was conducted was to compare the results of earlier research on repeated readings to those of computer-controlled systems. The other two reasons were not related to Computer Assisted Instruction. These two reasons were to investigate whether gains in performance transfer to new material and to discover if participation in reading practice for extended periods of time result in better general reading ability. Two groups of six high-school students were the subjects of this study. Each group participated in the study at different times, but the results of each study support the other. The students used repeated readings until a satisfactory level of fluency was obtained. Fluency is associated with both accuracy and rate of reading. At the conclusion of the study, the discovery is noted that each group managed to steadily improve their rate and accuracy of reading new initial passages using the same programmed prose method. Transfer to other reading tasks was not as clearly supported.

CAI AND READING COMPREHENSION: RESEARCH IN THE UNIVERSITY SETTING

Blohm, Paul J. "Effect of Structural Cueing and Decision Type for Improving Retention of Technical Text." Reading-Psychology 7.2 (1986): 77-85.

In this study, sixty college students from undergraduate teacher preparation courses were exposed to an 1100-word essay on a monitor and asked to answer questions based on the text. The type of screen display differed for each of the two groups that composed the study. One group saw the essay with words typed in a single color. The other group found that some of the words were color-coded. The words written in white were main ideas or top-level ideas. The mid-level ideas were orange, and the base-level ideas were green. In each group, selected students were asked to answer rote memory questions. Others were asked to answer semantic-level decisions based on ideas presented in the text. Results were that color cueing made no difference on retention of the text, but that the administering of semantic-level questions aided in concept acquisition. In the discussion, the authors suggested that color-coding ideas be researched with younger students who may not have internalized organization of written text to the extent of these college students.

Siegel, Martin A., and A. Lynn Misselt. "Adaptive Feedback and Review Paradigm for Computer-Based Drills." Journal of Educational Psychology 72.2 (1984): 310-317.

Siegel proposed and implemented a research study using microcomputers which also employed philosophies of adaptive feedback. The computer was able to control the difficult sorting of questions and analysis of answers necessary to make adaptive feedback successful for the learner. The adaptive feedback approach was correlated with a student's posttest achievement and time to master the material. The subjects consisted of 102 college seniors who were enrolled in an educational psychology course. These 102 students were divided into six groups. Their task was to pair 20 English words with corresponding Japanese words. Two of the groups were offered increasing ratio review--review which allows a learner to try the missed item again before too much new learning has taken place. Two of the groups were offered immediate review only and adaptive feedback with training. That means that the incorrect answer was compared with the correct answer, either by simply telling the learned the correct answer or using the learner's answer as an answer for another question and supplying the correct answer for the missed question. The question was then placed at the end of the question list for later testing. One group was offered no review, but was given adaptive feedback. In the last group, the same type of error correction was given each time, but the increasing ratio review was employed. The results indicate that increasing ratio review supported fewer discrimination errors on the posttest than immediate review. Out-of-list errors also were significantly lower for the increasing ratio review groups. Although there were no significant differences in the number of out of list errors on the posttest for groups that received adaptive feedback only, when compared to groups that received adaptive feedback with their training, less discrimination errors were made. In addition, later review of missed items offers the same effect as no review at all. According to the discussion at the end of the article, these findings were significant in transferring learning from theory to computer assisted instruction.

Hepner, Frank H. and others. "Reading Performance on a Standardized Test is Better from Print than from a Computer Display." Journal of Reading 28.4 (January, 1985): 321-325.

Eighty-five subjects from the student, staff, and faculty of the University of Rhode Island took the Nelson-Denny Reading Test. Alternate "A" and "B" forms of the same test were administered to each student. One form was on a computer screen, and the other form was on paper. Each subject completed each form from both administration methods. No group of people (grouped according to age, minutes of TV viewing, minutes of reading, perceived reading speed, and videogame players) scored higher on the computer form of the test than on the printed form, although in 50% of the groups, a nonsignificant correlation was derived between the forms. According to the findings, and the manipulation of unanswered numbers of questions, the researchers here attributed the decreased score for the computerized version of the test to decreased reading speed from the computer terminal.

CAI AND READING COMPREHENSION: RESEARCH DONE WITH MILITARY PERSONNEL

Enochs, E. R., H. M. Handley, and J. P. Wollenberg. "Relating Learning Style, Reading Vocabulary, Reading Comprehension, and Aptitude to Learning to Achievement in the Self-Paced, Computer-Assisted Instructional Modes." Journal of Experimental Education 20.5 (February, 1980): 135-139.

Using a randomized pretest-posttest comparison group design for research, 50 Navy Yeomen "A" School students were selected for this study, and then divided in half. Half of the Yeomen received self-paced materials requiring independent study and instructor-individual interactions. The other half of the Yeomen received instruction using computer assisted instructional programs, which were written in a branched format featuring immediate machine feedback. The Yeomen were all given a Learning Styles Inventory prior to the implication of the study. Both groups showed equal aptitude on the Armed Services Vocational Aptitude Battery. After analysis, a significant difference in achievement gains was shown with the group using computer assisted instruction achieving higher than their counterparts. Achievement in reading comprehension, arithmetic reasoning, a preference for qualitative learning and work with inanimate objects was also more associated with achievement in the training group taught by computer assisted instruction than in the group taught by more traditional methods.

Smith, Shirley C. Using CBI to Develop Job-Related Reading and Study Skills: The PREST Curriculum for Navy Recruits. March, 1981 ERIC Silverplatter, 1981. record no. ED228991.

The Navy was looking for application of an Adult, Computer-Based educational system for their recruits that would be comprehensive; capable of raising reading skills to at least the sixth-grade level; designed for adults; efficient; designed to prepare recruits for basic training; Navy-job related; designed with a student/instructor ratio of 24 to one; readied in nine months; and developed and tested for less than $220,000.00. An existing Basic Skills Learning System (BSLS) was chosen and modified for use on the PLATO system. The areas of efficiency, effectiveness, and cost-effectiveness were considered when the experimental and control groups were examined for data collection. Findings suggested successful and acceptable gains in learning. A higher teacher/student ratio was allowable, and on-line drill and practice seemed more valuable than off-line work. Most time was spent on the acquisition of word analysis, literal comprehension, and study skills rather than sound-symbol relationships.

CAI AND READING COMPREHENSION: RESEARCH DONE WITH ADULTS WITH SPECIAL NEEDS

Baumgart, Diane, and John VanWalleghem. "Teaching Sight Words; A Comparison Between Computer-Assisted and Teacher-Taught Methods." Education and Training in Mental Retardation 22.1 (March, 1987): 56-65.

The purpose of the study documented here was to discover if Computer Assisted Instruction could be used by three adults to increase sight word recognition. The ultimate goal was to increase these adults' independence in a grocery store by increasing their ability to read the aisle headings. Thus, each student was exposed to 30 words which he/she could not recognize three out of three times during a baseline study. Fifteen unrecognized words were entered into a computer program for study, and fifteen were given to a teacher for traditional teacher instruction. Format for teacher-student interaction and computer-student interaction were matched as closely as possible. When results were tabulated, only one learner showed equal results in sight-word acquisition over the two methods. Each learner showed some off-task behavior during the course of the CAI strands of instruction, but none during the traditional teacher instruction strands. Discussion at the end of this writing revealed the need to improve the technology so that it better emulates teacher interaction and can be used in an efficient way for teaching mentally handicapped people.

SUMMARY

Computer assisted instruction has been used as a means to develop reading comprehension skills in students of all ages and abilities. In each catagory, few significant findings have been noted, and some concerns expressed in interpretation of the results.

In the elementary school student, time to complete the task seemed to be a single negative result that overlapped in the Zuk study as well as the studies done by Pitts and others and Reinking, who also noted that this decrease in time to complete the task due to the computer manipulation may also decrease comprehension. Strategies for comprehension were practiced by students in the Wells and the Reinking study, and results indicated that students apply these strategies more in reading independently after learning them by means of computer assisted instruction. No study indicated an overwhelmingly more effective result when CAI was used over traditional instruction except the Martha Holden Jennings study conducted at Bath Elementary School. The results of the CAI program there increased student achievement by 2.4 months over traditional instruction during the same time-period. This study, however, made no mention of the Hawthorne Effect, which may have been a large factor due to the fact that the study was conducted on a new method, and that CAI was administered for a limited amount of time. No follow-up study was administered, and extreme teacher enthusiasm toward CAI was noted in the documentation of the study. When looking across economic factors, the results remained the same. Likewise, intellectual factors did not seem to make a difference in the effects of computer assisted instruction on the acquisition of reading comprehension skills. Studies conducted with children in the elementary grades repeatedly

mentioned the enhanced motivation and increased positive attitude toward learning in students while using CAI. The ability to individualize learning also seemed to be a concern that computer assisted instruction was able to address with positive outcomes in both ease of management and student benefit.

Individualization continues to be a concern and an area where computer assisted instruction seems especially beneficial in secondary education. Smaller, individualized sets of learning tasks were found to be easily managed and resulted in more efficient learning when CAI was applied according to the Johnson, Gersten, and Carnine study. Unlike the slower rate of Reading illustrated in the Zuk elementary study, the Carver study in secondary students seemed to indicate an increase in reading accuracy and rate among children at this level when CAI is applied to reading comprehension tasks. When applying comprehension monitoring strategies using a microcomputer, the Mizner study showed that secondary students, like elementary students, seem to spend more time finishing the lesson. Another similarity to the elementary findings is in the numerous times that increased enthusiasm and motivation were mentioned when CAI was introduced as a methodology. Where significant positive results were noted, caution seemed to follow in virtually every abstract. Whether the reason was possible differences in methods of presentation rather than methods of learning as in the Diamond research, or the fact that perhaps only one area of an achievement test was altered to show positive results like in the Miller and Macleod study, the call for further research was made. At the secondary level, like the elementary level, CAI and reading comprehension seem to be viable partners, but more studies are needed.

When studies that have been done on University students were analyzed, one unique aspect of CAI was investigated. This concern was the presentation of text on the monitor of the computer. Computers allow not only manipulation of text, as illustrated in previously discussed studies, but also a different way of presenting text. Highlighting main ideas, supporting details, and important pieces of information seemed to have no effect on students in university settings, presumably because they had already internalized these organizational skills; however, this type of study may have implications for less academically advanced students as they work to acquire the organization necessary for acquisition of reading comprehension skills (Blohm, 198). At the university level, studies have been done reflecting those at other levels of education. Individualization of areas of study were found to be of significant value in the Siegel and Misselt study. Some difficulties in manipulating text resulted in increased time to complete a task, hence, reflecting less achievement in the study conducted by Hepner and others.

The postive aspects of CAI when used with students in the area of reading comprehension seem to grow when the studies done by the Navy are considered. Two new ideas were noted in the two research studies documented in the articles by Enochs, Handley, and Wollenberg and Smith. The Enochs, Handley, and Wollenberg study of Naval Yeomen applied the principles of Learning Styles to achievement gains. Yeomen who received computer assisted instruction showed significant achievement gains above those of Yeomen who received self-paced materials requiring independent study and instructor-individual interactions. Those students whose learning styles showed preferences for qualitative learning and work with inanimate objects seemed to benefit the most from interaction with the CAI program. Smith's research documented that because of individualization

of instruction and immediate feedback, adult recruits seemed to learn better, and the student/teacher ratio could be increased.

Perhaps it is this learning style aspect that led to the lack of achievement in mentally retarded adults in the area of sight-word recognition and development of reading comprehension for life skills applications when CAI was applied to their area of study. Baumgart and VanWalleghem found in their study that mentally retarded adults tended to show off-task behaviors during CAI that were not noted when these people interacted with a teacher in a traditional format. Software development that avoids both qualitative aspects and feedback that is not user-friendly may reveal a way to successfully use CAI with mentally handicapped people.

CONCLUSIONS

The documented articles, and related articles read that are based on research seem to indicate that CAI does have its place in the Reading classroom. Just where computer assisted instruction should and should not be used remains a question, as does the issue of student benefit from computer assisted instruction in the area of reading comprehension.

Some aspects of CAI and its effects on reading comprehension appear to be redundant in many documents. These aspects include the ability that CAI has to individualize student work. Students using computer assisted instruction are undoubtedly allowed to have a differentiated curriculum even when using the same programs when appropriate software is selected. In virtually every piece of research where this opportunity was allowed, learning occurred more efficiently for students.

Students spend more time in most cases on the lessons when CAI is incorporated as part of the curriculum in the area of reading comprehension as opposed to the time spent on lessons in more traditional settings. Whether this is a result of the manipulations necessary to continue text on a microcomputer screen, or if the result is caused from greater interest and allowance of more freedom to apply comprehension strategies seems unclear. Likewise, the answer to whether or not the additional time spent on the task results in more learning remains a question mark.

An increase in interest in lessons, and motivation to complete lessons is almost always assured when CAI is introduced as a method of teaching or practicing reading comprehension skills. The Hawthorne effect was never mentioned in the research as a possible cause for this discrepancy. This may be

an area that study-developers may wish to take into account in the future as an explanation for the different attitude displayed in nearly every incidence. Newer teaching techniques do not always indicate better teaching techniques. Researchers need to assure those who are advised to follow a particular path that perhaps the results they see are incurred because of student expectations resulting in actualizations that are unreliable. If this happens, then the increase in achievement may be short lived.

Some possibilities for CAI as it relates to reading comprehension that need more investigation include the effects of a person's learning style to his or her achievement when computer assisted instruction is employed as a teaching tool. Whether or not student/teacher ratio can be increased when CAI is integrated is another area where more research is needed. Also an idea that asks for investigation is whether or not presentation of text (using different fonts or colors) may help young students internalize comprehension strategies.

RECOMMENDATIONS

It is recommended that:

1. Computer assisted instruction be used more extensively as a way to achieve individualization in the area of reading comprehension.
2. Teachers be aware of and sensitive to individual learning styles prior to implementing computer assisted instruction.
3. Long-term studies be conducted on the effects of CAI on reading comprehension so that the Hawthorne effect can be explored.
4. The role of CAI in reading comprehension remains, at least for now, a means to an end rather than an end in and of itself until more research can be conducted and more conclusive results obtained.

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